June 27, 1950 L. H. BARGHAUSEN 2,513,134

ARTIFICIAL LIMB KNEE STRUCTURE

Filed July 28, 1949 2 Sheets-Sheet 1

Fig. 1.

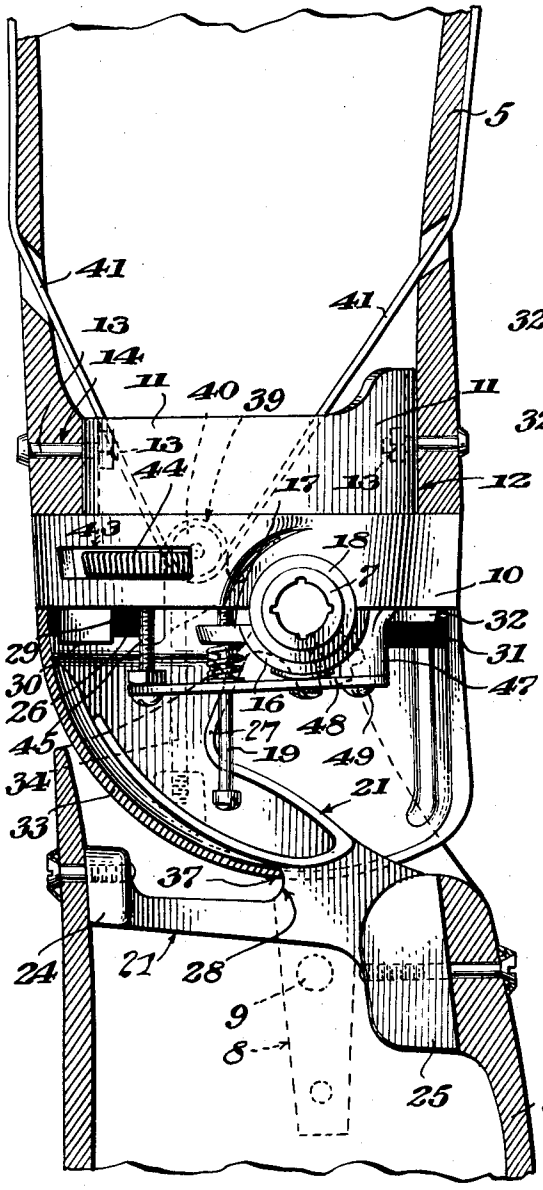


Fig. 2.

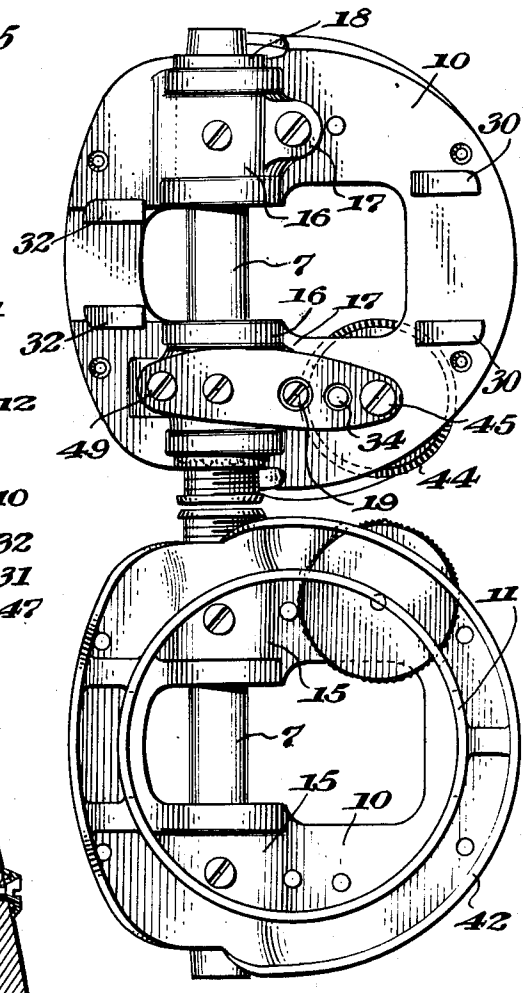


Fig. 3.

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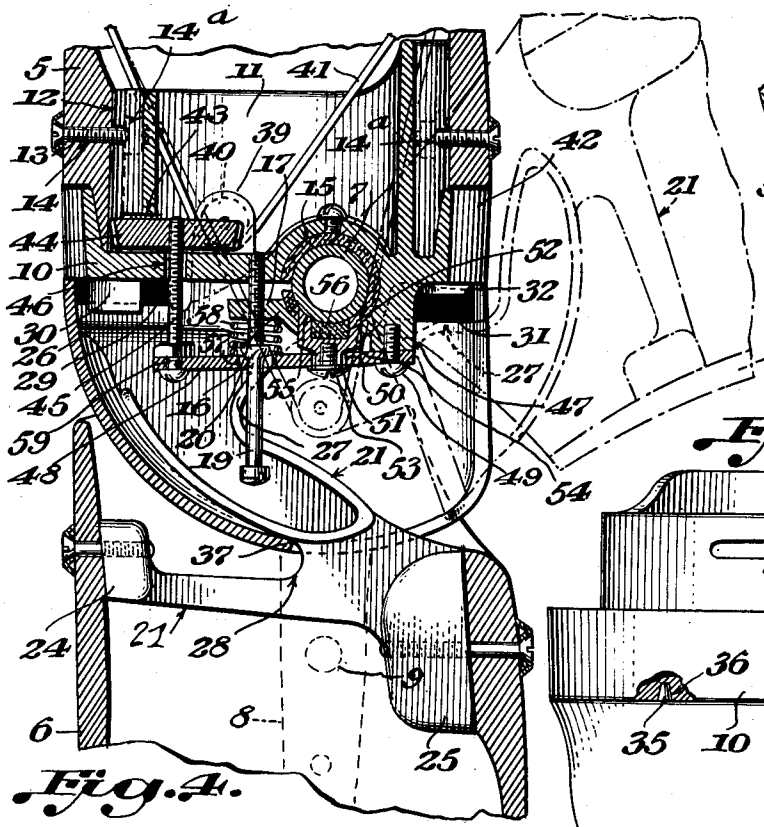


Fig. 4.

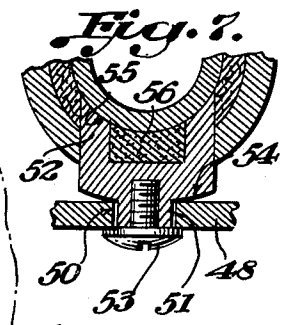


Fig. 7.

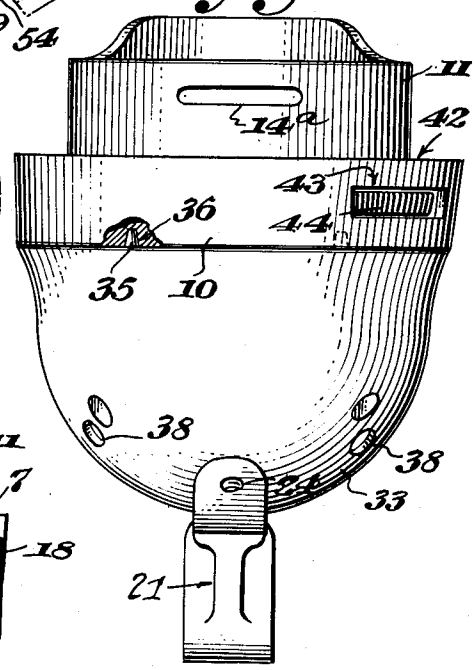


Fig. 6.

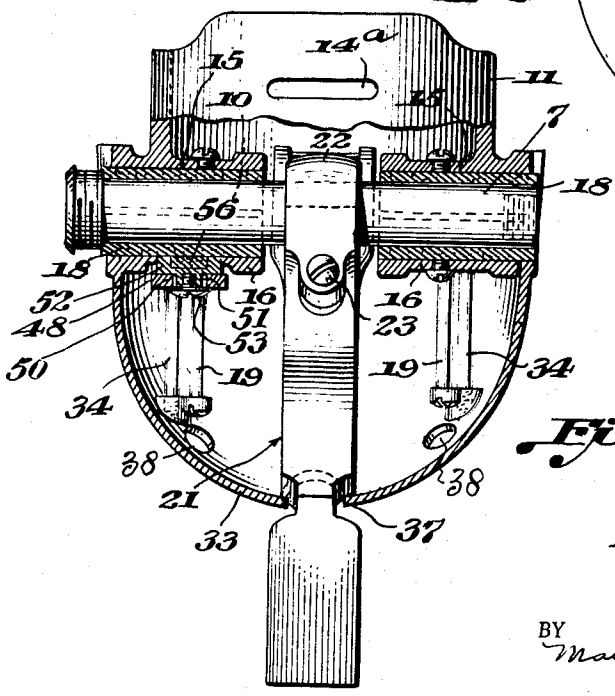


Fig. 5.

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ARTIFICIAL LIMB KNEE STRUCTURE

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Application July 28, 1949, Serial No. 107,268

11 Claims. (Cl. 3—2)

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The invention relates generally to artificial limbs and primarily seeks to provide a novel metal knee structure by which the thigh and shank sections of an artificial limb may be articulated, novel means being included for quickly and conveniently adjusting the friction resisting swinging movement of the shank section on the thigh section so as to suit the gait of the particular wearer of the limb, or to take care of varying demands due to changes in climatic conditions or variations in temperature within doors or out of doors.

In the U. S. Letters Patent 2,078,595 issued to me on April 27, 1937, there is disclosed a metal knee structure having outstanding advantages in standardizing artificial limb construction, the knee being so constructed and arranged as to be subject to substantially universal use in the articulation of a considerable range or span of thigh and shank sizes, and readily adjustable to peculiar anatomical characteristics of particular wearers. It is a purpose of the present invention to provide certain new and useful improvements in the form of knee structure shown in said patent, and to provide novel knee friction adjusting devices in this type of knee which can be manipulated by the wearer of the limb without the necessity of using tools, or repairing to any place of privacy, it being possible to effect the desired adjustment with great facility by a simple inconspicuous finger manipulation.

An object of the invention is to provide an improved metal knee structure of the character stated wherein there are included novel means for adjusting the thigh section on the knee structure and including a cylindrical collar or extension on said knee structure adjustably received in said thigh section and secured therein by elongated slot and bolt connections.

Another object of the invention is to provide an improved metal knee of the character stated wherein there is included a novel arrangement of knee check adapted to limit swinging movement of the shank section on the thigh section both in the forward and the backward direction.

Another object of the invention is to provide an improved knee structure of the character stated wherein there is included a removably mounted cap closing over the friction adjusting devices, novel receiving socket and pin devices being included for insuring proper alignment of said cap on the knee plate and proper retention of the cap shape.

Another object of the invention is to provide an improved knee structure of the character stated in which there are included a knee plate

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secured to the thigh section and having friction bearings for a knee bolt, a knee check secured to the shank section and to said bolt, a brake shoe engageable with the knee bolt for applying variable friction thereto, and a finger wheel for adjusting the application of friction by the shoe and extending through a slot in the knee plate for convenient finger manipulation by a wearer of the limb.

Another object of the invention is to provide an improved knee structure of the character described in which the knee bolt forming part of the knee hinge, and which is movable with the shank section, passes through two friction bearings each of which is adjustable, and one thereof having an opening in which is mounted a knee bolt engaging brake shoe, means being included for adjusting the degree of pressure applied by said shoe to the knee bolt to frictionally resist movement thereof.

Another object of the invention is to provide an improved knee structure of the character stated in which the brake shoe is supported, intermediately of the ends of a presser bar, one end of said bar being anchored to the knee plate, and the other end having connection with a screw threaded through an adjuster wheel held captive in a slot from which the periphery of the wheel projects for finger manipulation whereby upon turning of the wheel the screw will be moved one way or the other in the direction of its length to press the brake shoe more tightly against the knee bolt or to relieve said pressure.

Another object of the invention is to provide an improved knee structure of the character stated in which there is included an individual adjustment for the frictional contact applied by each bearing to the knee bolt, in addition to the adjustment of the brake shoe, and in which there is included spring means constantly tending to move the brake shoe away from the knee bolt.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a detail vertical cross section illustrating portions of a thigh section and a shank section articulated by a metal knee structure embodying the invention, the friction adjusting devices and the knee plate being shown in side elevation.

Figure 2 is an inverted plan view of the knee

plate of the knee structure and the friction adjusting devices mounted thereon.

Figure 3 is a top plan view illustrating the parts shown in Figure 2.

Figure 4 is a view similar to Figure 1, the knee plate and the friction adjusting devices being shown in section, the shank section being in its forward stop position in full lines, and in its rearward stop position in dot and dash lines.

Figure 5 is a vertical cross section of the knee structure taken through the axis of the friction devices.

Figure 6 is a front elevation of a knee structure, a right knee being shown.

Figure 7 is an enlarged detail section illustrating the brake shoe and its attachment to the presser bar.

In the example of embodiment herein disclosed, the improved knee structure is shown as incorporated in an artificial limb including the usual thigh section 5 and shank section 6 pivotally connected by a knee bolt 7 which passes through the usual side arms 8 which are riveted or otherwise secured as at 9 to the shank section. The knee structure includes a knee plate 10, the lower face of which lies in the same horizontal plane with the axis of the knee bolt, and the plate includes an upstanding collar or flange 11 which is circular in horizontal cross section and adjustably fits within a circular bore 12 formed in the lower end of the thigh section 5. It will be readily apparent that during the fitting of the limb the knee structure and the attached shank section may be turned axially within the thigh section bore 12 in order to adjust the direction of projection of the attached foot and properly line up the limb, and the selected adjustment may be secured by use of the screw bolts 13 which pass through holes 14 in the thigh section and elongated slots 14a formed in the knee plate collar or flange 11.

The knee plate 10 also includes two half cylindrical depressions or recesses 15 which are opposed by cast extension portions 16 terminating in adjuster ears 17 which are spaced from the plate in the manner clearly illustrated in Figures 1, 2 and 4 of the drawings. The depressions 15 and the extension portions 16 form bearings in which to receive split bearing sleeves 18 which may be formed of fiber or comparable acceptable bearing material in which to receive the knee bolt 7. A longitudinal screw 19 extends through a bore in each adjuster ear 17 and into a receiving tap in the plate 10, and on each said screw is included and adjuster head 20 which engages the respective ear 17 so that upon adjustment of the screw in one direction or another the respective bearing sleeve 18 may be contracted or permitted to expand so as to vary the friction applied to the knee bolt and effective to resist free turning thereof within said sleeves.

The central portion of the knee plate is cut away in the manner clearly illustrated in Figures 2, 3 and 5 of the drawings in order to accommodate the knee check which is generally designated 21, and said knee check includes a hub 22 which is split and securely clamped by a screw 23 about the knee bolt 7. Thus it will be apparent that the shank section, the knee check 21 and the knee bolt 7 swing in unison. The knee check is secured at the front as at 24 within the shank section 6, and also at the rear as at 25 within said shank section. This knee check is shaped in the manner clearly illustrated in Figures 1, 4, 5 and 6 of the drawings to provide a front check stop 26, a rear check stop 27 and a cap clearance 28. The front check stop 26 is engageable with a bumper 29 mounted as at 30 on the knee plate 10, and the rear check stop 27 is engageable with a bumper 31 mounted as at 32 on said knee plate. Engagement of the front check stop 26 with the front bumper 30 limits swinging movement of the shank section in the forward direction at the position illustrated in Figures 1 and 4, and engagement of the rear check stop 27 with the rear bumper 31 limits swinging movement of the shank section in the rearward direction in the manner indicated in dot and dash lines in Figure 4.

A knee cap 33 is secured to the knee plate 10 by screws 34, and aligning tapered dowel pins 35 project from the upper edge of the knee plate and are engageable in aligning recesses 36 provided in the knee plate 10. The engagement of the tapered pins 35 in the recesses 36 serves to maintain the meeting edges of the knee plate and the knee cap in alignment, and should there be any springing of the knee cap during casting or hard usage, said aligning pins and recesses will serve to draw the parts into proper cooperative relation and alignment. It will be apparent by reference to Figure 6 that the knee cap also includes apertures 38 through which the tension adjuster screws 19 may be manipulated.

The center opening in the knee plate 10 also clears the crank extension 39 provided on the knee check 21, said extension being equipped with a roller 40 under which passes bight of a control strap 41 depending from the usual belt or other control harness (not shown). It is well known in the art that the connection of the strap 41 with the crank roller 40 enables the wearer of the limb to exert an upward pull on the crank extension which is effective to throw the shank section forward during walking, and by this manner of controlling the swinging movement of the shank section, in conjunction with proper control of the friction, the wearer of the limb is enabled to walk with the artificial limb with ease and comfort.

It will be noted by reference to Figures 1, 3, 4 and 6 of the drawings that the knee plate 10 includes an upstanding outer abutment flange 42, and in this flange and in the collar or flange 11 a slotway 43 is provided in which an adjuster wheel 44 is rotatably confined with its periphery projecting only slightly through the outside of the slotway in the manner clearly illustrated, especially in Figures 2 and 3. The captive wheel 44 is threaded on an adjuster screw 45 which passes through a smooth bore 46 in the knee plate 10 in line with one of the laterally disposed friction bearings. At the side at which the adjuster wheel 44 is mounted, the knee plate is equipped with an anchor lug 47 to which a heavy but flexible presser bar 48 is anchored at one end as at 49. The adjustably anchored presser bar is apertured as at 50 to receive a reduced hub extension 51 of a brake shoe 52, preferably formed of bronze. The reduced hub extension 51 is floatably secured to the presser bar 48 and within the aperture 50 by means of a screw 53, and the outer face of the brake shoe 52 which opposes the presser bar 48 preferably is curved as at 54. It will be apparent by reference to Figures 4, 5 and 7 of the drawings that the inner face of the brake shoe is curved, as at 55, on the same radius as the outer surface of the knee bolt 7 so as to lie snugly thereagainst for braking contact therewith, and said face is

recessed to receive a filler 56, preferably of leather or other suitable non-metallic material impregnated with graphite. The filler may act as a lubricant alone or as a lubricant and a grip surface, the idea being to provide just the right amount of friction and yet assure against galling. It is to be understood, however, that the main braking action or friction application is provided by the metal to metal contact between the bronze shoe surface 55 and the knee bolt 7.

It will be apparent by reference to Figure 4 that the presser bar 48 is provided with an aperture 57 for clearing the adjuster screw 19 and the head 20 thereof associated with the respective bearing ear extension 17, and a compression spring 58 surrounds said screw between the adjacent ear 17 and the opposing face of the bar 48 and serves to constantly urge the bar in a direction for displacing the brake shoe 52 from its friction controlling contact with the knee bolt 7. The adjuster screw 45 to which longitudinal movement is imparted by rotation of the finger wheel 44 is anchored to the free end of the presser bar 48 as at 59.

It will be apparent that by adjusting the screws 19 the amount of friction applied by the bearing sleeves 18 to the knee bolt 7 may be varied at will. This applied friction is supplemented by the friction control provided by the brake shoe 52 and of the controlling finger wheel 44. It will be readily understood that the friction requirements for controlling the swing of the shank section in accordance with the gait of a particular wearer or demands of varying climatic conditions will demand that the changes in the applied friction can be made when necessary and with convenience. The improved finger wheel control 44 serves this need and makes it possible for the wearer of the limb to adjust the friction to a nicety by finger engagement with the periphery of the wheel 44 effective to increase or diminish friction pressure application of the brake shoe 52 against the knee bolt.

The herein described metal knee structure provides marked advantages in the facility with which it can be initially incorporated in the thigh section and adjusted therein to suit the requirements of the particular wearer. It is of marked advantage to provide the efficient checking of the shank movement both in the forward and rearward direction, and the simple finger wheel adjustment 44 which enables the adjustment of the friction applied to the knee bolt by the wearer himself, without the use of special tools and without the necessity of seeking a place of privacy in which to make the manipulation.

While one form of the invention has been shown for purposes of illustration it is to be clearly understood that various changes in the details of construction and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In an artificial limb, a thigh section, a shank section, means forming a pivotal connection between said sections and including a pivot bolt movable with one said section, and means carried by the other of said sections for applying variable frictional resistance to relative movement of said bolt and comprising, an elongated presser bar anchored at one end on said other section, a brake shoe attached to said bar and engaging the knee bolt, a screw attached to said bar, and a finger wheel held captive and rotatable on said other section and threadable on said screw whereby rotation of the wheel will impart longitudinal movement to said screw and through it movement to the brake shoe toward or from said bolt to increase or diminish frictional resistance to movement of the bolt.

2. Artificial limb structure as defined in claim 1 in which the brake shoe comprises a metal block having a braking face conforming in curvature to the external surface of the knee bolt and is carried by the presser bar intermediately of the ends thereof.

3. Artificial limb structure as defined in claim 1 in which the brake shoe comprises a metal block having a braking face conforming in curvature to the external surface of the knee bolt and including a non-metallic insert disposed for direct contact with the knee bolt in conjunction with the braking face.

4. Artificial limb structure as defined in claim 1 in which the brake shoe comprises a metal block having a braking face conforming in curvature to the external surface of the knee bolt and is floatingly mounted on the bar adjacent to the anchored end thereof, the screw being attached to the other end of the bar and the point of attachment of the brake shoe being closer to the anchored end of the bar than to the screw attached end.

5. In an artificial limb, a thigh section, a shank section, and means forming a pivotal connection between said sections and including a knee plate secured to the thigh section and having knee bolt bearing means thereon, and a knee bolt secured to and movable with the shank section and rockable in said bearing means, said bearing means having an opening therein exposing an external surface of the knee bolt, an elongated presser bar anchored at one end on the knee plate, a brake shoe attached to said bar and engaging the knee bolt through the bearing means opening, a screw attached to the bar, and a finger wheel held captive and rotatable in a slot in said plate and extending slightly through the slot beyond the peripheral edge of the plate for finger manipulation and threadable on said screw whereby rotation of the wheel will impart longitudinal movement to said screw and through it movement to the brake shoe toward or from said bolt to increase or diminish frictional resistance to movement of the bolt.

6. Artificial limb structure as defined in claim 5 in which the knee bolt bearing means comprises a pair of laterally spaced split bearings in one of which the brake shoe receiving opening is formed, there being included means for individually adjusting the bearings to apply movement resisting friction to the knee bolt with relation to which the finger wheel manipulation constitutes supplementary friction adjustment.

7. Artificial limb structure as defined in claim 5 in which the knee bolt bearing means comprises a pair of laterally spaced split bearings in one of which the brake shoe receiving opening is formed, there being include means for individually adjusting the bearings to apply movement resisting friction to the knee bolt with relation to which the finger wheel manipulation constitutes supplementary friction adjustment, and wherein the brake shoe is floatingly mounted on the bar adjacent to the anchored end thereof, the screw being attached to the other end of the bar and the point of attachment of the brake shoe being closer to the anchored end of the bar than to the screw attached end.

8. Artificial limb structure as defined in claim

5 in which the knee bolt bearing means comprises a pair of laterally spaced split bearings in one of which the brake shoe receiving opening is formed, there being included a screw means for adjusting each bearing to apply movement resisting friction to the knee bolt, one said screw means passing through an aperture formed in the presser bar, and there being included a compression spring interposed between the presser bar and the adjacent bearing and about said one screw means and effective to constantly tend to move the bar in a direction for relieving the pressure of the brake shoe against the knee bolt.

9. Artificial limb structure as defined in claim 5 in which the knee plate has an upstanding circular collar adjustably mounted in a bore in the lower end of the thigh section so that by turning the collar in said bore the angular relation of the thigh and shank sections can be varied.

10. Artificial limb structure as defined in claim 5 in which the knee plate has an upstanding circular collar extending into and turnable in a bore formed in the lower end of the thigh section, said collar having longitudinal slots therein and being secured to the thigh section by bolts passing through said slots and through apertures in the thigh section and permitting adjustment of the collar in the bore effective to vary the angular relation of the thigh and shank sections.

11. In an artificial limb, a thigh section, a shank section, a knee forming a pivotal connection between said sections, said knee including a pivot bolt, a knee plate secured to the thigh section and having a centrally disposed control device accommodating opening, control devices operable in part in said opening and including a knee check secured to said shank section, and a control strap bight receiving crank, said knee plate including a knee bolt bearing at each side of the center opening, one said bearing having an opening therein through which the knee bolt is exposed, and variable friction applying means comprising a brake shoe projecting through said bearing opening into contact with the knee bolt, and means for applying the shoe to the knee bolt with variable pressure including an adjuster wheel mounted on the knee plate and extending a limited distance outwardly therefrom for finger manipulation.

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REFERENCES CITED

The following references are of record in the file of this patent:

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2,078,595	Barghausen	Apr. 27, 1937
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